Application No.: 10/665,914
Dated: September 21, 2005
Amendment

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claim 1 (currently amended): A free piston Stirling engine comprising:

a displacer;

a housing within which displacer reciprocates in both a first axial direction and a second axial direction; and

a machined spring having a first end and a second, said first end attached ~~at a first end~~ to said displacer and providing a constraining force upon said displacer when said displacer moves in either said first axial direction or said second axial direction, said second end of said machined spring attached to a displacer rod; ~~wherein~~, said machined spring further including ~~comprises~~ first and second end portions and a plurality of helical coils located therebetween;

wherein said machined spring is characterized such that the mass of said displacer and said displacer rod and the force constant of said machined spring results in mechanical resonance at the operating frequency of said free piston Stirling engine.

Claim 2 (cancelled).

Claim 3 (original): The free piston Stirling engine of claim 1 wherein said machined spring is attached to said displacer with at least one mounting screw.

Claim 4 (cancelled).

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Claim 5 (original): The free piston Stirling engine of claim 1 wherein said machined spring is formed as at least two intertwined coils of material.

Claim 6 (original): The free piston Stirling engine of claim 5 wherein said material is steel.

Claim 7 (cancelled).

Claim 8 (previously presented): The free piston Stirling engine of claim 1 wherein said helical coils are intertwined.

Claim 9 (original): The free piston Stirling engine of claim 1 wherein said machined spring is formed from a single piece of rod stock.

Claim 10 (original): The free piston Stirling engine of claim 1 wherein said machined spring is contained within said displacer.

Claim 11 (currently amended): A displacer in a free piston Stirling engine comprising:

a displacer rod;

a displacer housing within which said displacer rod reciprocates; and

a machined spring attached at a first end to at least a portion of said displacer rod and providing a constraining force upon said displacer rod when said displacer rod moves in either a first axial direction or a second axial direction within said displacer housing; ~~wherein,~~ said machined spring further including ~~comprises~~ first and second end portions and a plurality of helical coils located therebetween;

wherein said machined spring is characterized such that the mass of said displacer and said displacer rod and the force constant of said machined spring

results in mechanical resonance at the operating frequency of a free piston Stirling engine containing said displacer.

Claim 12 (original): The displacer of claim 11 wherein said machined spring is attached at a second end of said machined spring to said displacer housing.

Claim 13 (cancelled).

Claim 14 (original): The displacer of claim 11 wherein said machined spring is formed as at least two intertwined coils of material.

Claim 15 (original): The displacer of claim 14 wherein said material is steel.

Claim 16 (cancelled).

Claim 17 (previously presented): The displacer of claim 11 wherein said plurality of helical coils are intertwined.

Claim 18 (original): The displacer of claim 11 wherein said machined spring is contained within said displacer.

Claim 19 (previously presented): A method of optimizing a free piston Stirling engine having a displacer and displacer rod, comprising the steps of:

(a) machining a displacer spring having a first end, a second end and a length defined by the distance between the first end and the second end;

(b) positioning a plurality of coils within the length of the displacer spring so as to optimize a natural frequency of the spring; and

(c) installing the spring so machined by attaching the first end to at least a portion of the displacer rod and providing a constraining force upon the

displacer rod when the displacer rod moves within a displacer housing of the free piston Stirling engine in either a first axial direction or a second axial direction;

wherein in step (b) positioning the coils closer to the second end of the spring reduces total moving mass, thereby increasing the natural frequency of the free piston Stirling engine and positioning the coils closer to the first end of the spring increases total moving mass, thereby decreasing the natural frequency of the free piston Stirling engine.

Claim 20 (previously presented): The method of claim 19, wherein the displacer spring is attached at the second end to a displacer housing.

Claim 21 (previously presented): The method of claim 19, wherein the displacer spring is characterized such that the mass of the displacer and the displacer rod and the force constant of the displacer spring results in mechanical resonance at the operating frequency of a free piston Stirling engine containing the displacer.

Claim 22 (previously presented): The method of claim 19, wherein the displacer spring is formed as at least two intertwined coils of material.

Claim 23 (previously presented): The method of claim 21, wherein the material of the displacer spring is steel.

Claim 24 (previously presented): The method of claim 21, wherein the plurality of coils is of helical configuration.

Claim 25 (previously presented): The method of claim 23, wherein the plurality of helical coils is intertwined.

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Claim 26 (previously presented): The method of claim 19, wherein the displacer spring is contained within the displacer.